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BOTANY AT THE FAIR.

BY H. L. BOLLEY, FARGO, NORTH DAKOTA.

Aside from the extensive opportunities for notes and observations upon miscellaneous herbaria and growing plants, collected from all parts of the earth, which are open to visitors of the Fair, it may not be inappropriate to note some of the special attractions for such persons as are botanically inclined.

While the name *Horticulture* has the place of honor upon the great plant house in the west portion of the Park, the place is none the less of botanical interest. Indeed, if adverse criticism is at all deserved in this department, it would be along the line that it is more a huge botanic garden than a horticultural show.

The amateur botanist, who, at his place of training, has complained that he has not been afforded sufficient opportunity for observation upon varied plant life, may in this building introduce himself to almost all known varieties of cultivated flowering and ornamental plants, which are representative of all lands. It is useless to attempt citations. None shown, however, are of more interest than the specimens representative of dwarfing methods, as conducted by the Japanese gardeners.

Grasses: Each exhibitor, fully understanding the importance of grasses and forage plants in an agricultural exhibit, has made careful effort to have his State or region fully represented as to its capabilities of producing these lines of plants. The great agricultural hall and the different State and national buildings thus present, in the aggregate, a list of native and cultivated grasses, more extensive as to numbers and more properly prepared for educational effect as to their qualities, form, growth, characteristics, etc., than it has ever previously been possible for any one to examine. Many of the States have full displays in bunch form, showing all characters, roots, leaves and seeds; while, again, ordinary herbarium specimens are to be noted almost anywhere one may go in the agricultural exhibits.

College and Experiment Station Exhibit: Located in the southeast corner of the agricultural building is the collective exhibit of agricultural colleges and experiment stations. Here again in the botanical alcove the varied nature of the exhibits makes it probable that few may pass through without noticing something individually interesting. Necessarily, the above is arranged more for show purposes than as a working laboratory, yet very much of the best work that has been done at the different stations is here represented, either by work in actual operation, apparatus, or by results graphically displayed. There are numerous photographs and drawings representing results gained in accurate experimental tests, as, for example, graphic results in crossing, by L. H. Bailey; results obtained in spraying for potato rot, by L. R. Jones, and many others. Photographs are shown of European and other foreign botanists, together with nearly a full list of our experimental botanists.

All the more common plant diseases are represented by pathological specimens, drawings, microphotographs and maps of distribution. This exhibit is a most varied and interesting one, containing, aside from the numerous specimens representing rusts, smuts, mildews, bacterial diseases, etc., many illustrations of results gained in prevention of plant diseases, such, for example, as grape rot, apple scab; potato rot and potato scab.

Different methods of seed-testing are in operation, displaying, among others, the following pieces: Nobbe's apparatus, Kiel-Zurich-Geneva germinator, the North Carolina seedpan, and E. S. Goff's various improved appliances. There are also illustrations of water and sand cultures, and various appliances and specimens too numerous to be listed at this time, among which may be noted B. D. Halsted's weeds and weed seeds, an exhibit of root tubercules upon native legumes, good microscopic exhibits, and T. L. Scribner's complete micro-photographic outfit.

Plant Physiology: A case full of apparatus for the study of special questions in plant physiology, prepared by Prof. J. C. Arthur, is worthy of special notice by any one who may pass through the laboratory. With the exception of a few standard pieces, all the different appliances had their origin and construction in the Purdue laboratories, and in finish are elegant examples of student work. Only mention may be made of a few of the more interesting pieces. Suffice it to say that probably no laboratory in the country has at this time an equally interesting collection of original or modified pieces for this sort of work. Noticeable among these are the following: Respiration appliances, a modification of Sach's method for determination of amount of carbon dioxide exhaled by plants; an apparatus for the comparison of normal and intramolecular breathing of seedlings, and one to illustrate intramolecular breathing of yeast in an atmosphere of carbon dioxide gas; auxanometers of three types of construction; chuostats of common type and one of intermittent action. This last piece is new and original, of elegant construction, and is especially applicable to the study of the force of habit as evidenced in plant life. There are dynamometers of various types for measuring various plant forces; transpiration pieces, including a potetometer for the quantitative determination of the amount of water given off by a given leaf surface in a given length of time; a poroscope; root-pressure appliances, and many smaller pieces, which are quantitative in their results. With all these contents, this case is worthy of the close consideration of any person interested in plant physiology. If all the pieces are not as suited to their work as might be wished, they are at least much to be preferred to those with which most of us have worked, and indicate future possibilities of more accurate results in this field of botany. Finally, there is a chance for most interesting study in two bacteriological laboratories, each fitted with all the latest and more essential appliances.

BIOLOGICAL SURVEY OF INDIANA.

At the last meeting of the Indiana Academy of Science, at Terre Haute, a Biological Survey was established for the State of Indiana, and Prof. Lucien M. Underwood, Greencastle, Ind., Division of Botany; Prof. Carl H. Eigenmann, Bloomington, Ind., Division of Zoölogy; Prof. Vernon F. Marsters, Bloomington, Ind., Division of Palæontology, were appointed Directors to organize the survey and outline the preliminary work ordered by the Academy.

It is the purpose of the survey: (1) To ascertain what has already been accomplished in the direction of making known the character and extent of the life of the State, and to this end to prepare a complete bibliography of materials bearing on the botany, zoölogy and palæontology of Indiana, to be published by the Academy. (2) To associate the various workers throughout the State, and so correlate their labors that all will work together towards a definite end, and ultimately accomplish the main purpose of the survey, namely,—the making known of the entire fauna and flora of Indiana, its extent, its distribution, its biological relations, and its economic importance. (3) To stimulate the teachers of biology throughout the State to encourage in their pupils the accumulation of material, which shall make known the local extent and distribution of life-forms, and thus contribute facts that will be useful in the survey and at the same time develop acute observers for continuing the study of the natural resources of the State. It is thus intended that the colleges and secondary schools will form with the survey a mutually helpful relation. (4) Ultimately to secure for the Academy a collection that will illustrate the biology of the State. Until such collection can be otherwise provided for, the Academy will designate certain public or private collections where accumulated material may be deposited temporarily. Material sent to the directors will be thus held for the future disposition of the Academy.

It is earnestly requested that all persons interested in any department of biological work will place themselves in relations with the Directors of the survey at once in order that their work may be made to contribute the most effectively to the public good, and in order that the Directors may know on whom they may depend for gaining information from various portions of the State. All contributions from persons interested will be properly credited in the reports of the survey. Correspondence is solicited with the director of the particular branch in which any one is interested, and such directions in regard to collecting and sending material will be given on application. By the assistance of the Smithsonian Institution, the directors are able to send printed directions for collecting to such as apply for them. In ordering these it will be necessary to specify in what particular branch information is desired.

It is the purpose of the Division of Botany during the present year to make such additions and corrections to the published "Catalogue of the Plants of Indiana" as are possible, and to secure definite information regarding the distribution of such rare forms as are there published.

Specimens illustrating the distribution or occurrence of any plant within the limits of the State must be deposited with the survey before any notice of their belonging to the state flora can be published. This will insure the ability to verify in future any fact published by the survey. In sending such material it is desirable that notes on the station, habitat, range and abundance of the plant be noted, together with any other information that will be of value. In addition to the flowering plants and ferns covered in the above, it is the intention of the Division to commence the study of the distribution of the lower cryptogams, concerning which almost nothing has been published from Indiana. While collections will be made of all forms, special attention will be given at present to the study of (1) Mosses, (2) Hepaticæ, and (3) Parasitic Fungi. Specimens are earnestly desired of all species, even those that are most common, from all portions of the State. It is desirable to state with each species the data indicated above, with particular reference to the habitat. In the case of parasitic fungi, it is necessary to indicate the host and to include sufficient quantity of the host plant, that doubtful determinations may be verified. The Director has been promised the assistance of specialists in the study of material accumulated.

The leading aim of the Division of Zoölogy during the season will be the compilation of a complete bibliography of the vertebrates of Indiana and of as many invertebrates as can be provided for.

At the same time any material showing the distribution of animals in the State is especially desirable. To determine the distribution, complete collections of the vertebrates of as many localities as possible should be made. Collections should always accompany notes, so that the observations may be verified by some specialist.

No opportunity should be neglected to observe the breeding habits and seasons, and the animal with young should, whenever possible, be preserved and forwarded to the Director, who will transmit it to the proper authority for record.

Another subject which should receive attention is the migration, or seasonal appearance and disappearance of mammals, birds, reptiles and fishes.

The next meeting of the Australasian Association for the Advancement of Science will be held in Adelaide, South Australia, commencing on September 25. The Association has now been in existence since 1888. Four meetings have been held, viz.: In September, 1888, at Sydney—President, H. C. Russell, C. M. G., B. A., F. R. S., Government Astronomer, N. S. W.; in January, 1890, at Melbourne—President, Baron F. von Mueller, K. C. M. G., Ph. D., F. R. S.; in January, 1891, at Christchurch—President, Sir James Hector, K. C. M. G., M. D., F. R. S.; in January, 1892, Hobart—President, His Excellency Sir Robert Hamilton, K. C. B. The meeting in Adelaide will be presided over by Ralph Tate, F. L. S., F. G. S., Professor of Natural Science at the University of Adelaide. Since its commencement the Association has grown steadily and now numbers about 900 members. The work is divided into sections as in the British Association, whose rules on most points have been closely followed. The Presidents of sections for the Adelaide session are: Section A.—Astronomy, Mathematics and Physics: H. C. Russell, C. M. G., B. A., F. R. S., Government Astronomer of New South Wales; Section B.—Chemistry: C. N. Hake, Chief Inspector of Explosives, Victoria; Section C.—Geology and Mineralogy: Sir James Hector, K. C. M. G., M. D., F. R. S., Director of the Geological Survey of New Zealand; Section D.—Biology: C. W. De Vis, Curator of the Brisbane Museum; Section E.—Geography: A. C. Macdonald, F. R. G. S., Hon. Secretary of the Victorian Branch of the Royal Geographical Society of Australasia; Section F.—Ethnology and Anthropology: Rev. S. Ella, New South Wales; Section G.—Economic Science and Agriculture: H. C. L. Anderson, M. A., Director of Agriculture, New South Wales; Section H.—Engineering and Architecture: J. R. Scott, Lecturer-in-Charge of the School of Engineering, Canterbury College, Christchurch, New Zealand; Section I.—Sanitary Science and Hygiene: A. Mault, Secretary to the Central Board of Health, Tasmania; Section J.—Mental Science and Education: Henry Laurie, LL. D., Professor of Mental and Moral Philosophy at the University of Melbourne.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

PROGRESS IN SANITARY SCIENCE IN MASSACHUSETTS.

BY GEORGE W. FULLER, LAWRENCE, MASS.

THE State Board of Health of Massachusetts, in addition to the ordinary duties devolving upon such a Board, have made much progress during the past six years in the study of many important problems in sanitary science.

In 1886 the Legislature made provisions (Chap. 274 of the Acts of 1886) that "the State Board of Health shall have the general oversight and care of all inland waters. . . . Said Board shall, from time to time, as it may deem expedient, cause examinations of the said waters to be made for the purpose of ascertaining whether the same are adapted for use as sources of domestic water supplies or are in a condition likely to impair the interests of the public or persons lawfully using the same, or imperil the public health. It shall recommend measures for prevention of the pollution of such waters, and for removal of substances and causes of every kind which may be liable to cause pollution thereof, in order to protect and develop the rights and property of the Commonwealth therein and to protect the public health. It shall have authority to conduct experiments to determine the best practicable methods of purification of drainage or disposal of refuse arising from manufacturing and other industrial establishments. For the purposes aforesaid it may employ such expert assistance as may be necessary.

"It shall from time to time consult with and advise the authorities of cities and towns, or with corporations, firms or individuals either already having or intending to introduce systems of water supply or sewerage, as to the most appropriate source of supply, the best practicable method of assuring purity thereof or of disposing of their sewage, having regard to the present and prospective needs and interests of other cities, towns, corporations, firms or individuals which may be affected thereby. All such authorities, corporations, firms and individuals are hereby required to give notice to said Board of their intentions in the premises, and to submit for its advice outlines of their proposed plans or schemes in relation to water supply and disposal of drainage or refuse."

The Legislature in 1888 made further provisions (Chapter 375 of the Acts of 1888) that "all petitions to the Legislature for authority to introduce a system of water supply, drainage or sewerage, shall be accompanied by a copy of the recommendation and advice of the said Board thereon."

In compliance with these provisions there was established by the Board an engineering department, whose main work may be divided into two classes: (1) The examination of proposed plans or schemes of water supply or sewerage submitted by the various cities and towns; (2) the examination of existing water supplies and inland waters of the State with reference to their purity.

With regard to the work of the first class it is to be noted that from July, 1886, when the act relating to water supply and sewerage first went into operation, up to January 1, 1893, there have been received 228 applications for advice. In the course of the investigations, instituted to develop the facts required as a basis for sound advice to the cities and towns, many valuable data have been obtained. The capacity, when fully developed, of sources of water supply drawn from ponds, lakes and streams, has been studied individually and in relation to the future needs of the great centres of population. Probable and comparative costs of different systems have been made; drainage areas have been surveyed, records of rainfall, temperatures, rates of increase of population and of consumption of water per capita have been kept and studied. All of these data have not only been of aid in the past but are also of great value for future reference.

Beginning in June, 1887, monthly analyses have been made of water from all the water supplies of the State, and of the more important rivers and other inland waters. At the outset every public water supply was visited by the engineers of the Board; a description and history of the different works were obtained; places for taking samples of water were chosen, and methods to be followed were explained to local officials. Much information was also gathered with regard to the physical characteristics of the water supplies,—such as the density of population on drainage areas, amount of polluting matter entering the streams, volume of water flowing, and temperatures of water. In addition to the chemical analyses which are made in the laboratories of the Board in Boston, at the Massachusetts Institute of Technology, examinations are made of the grosser forms of microscopic life, with the view to establish the relation between the micro-organisms and odors present in certain drinking waters. Bacterial analyses are also made from time to time.

Carefully prepared reports have been made of the results of these investigations. An idea of the nature of the work done can perhaps be best learned by looking at the following list of subjects, which are among those discussed in the annual and special reports:—

A Summary of Water Supply Statistics.

Classification of the Drinking Waters of the State.

Examination of Spring Waters.

Pollution and Self-Purification of Streams.

Typhoid Fever in its Relation to Water Supplies.

Suggestions as to the Selection of Sources of Water Supply.

Dissolved Oxygen in Waters of Ponds and Reservoirs at Different Depths.

Effect of Aeration of Natural Waters.

The Relation of Organisms and Odors in Natural Waters.

The Seasonal Distribution of Organisms.

In 1887 the Board established an Experiment Station at Lawrence. The object of this was to learn how to purify sewage and water. The Station was designed and its work planned by Mr. Hiram F. Mills, A. M., C. E., chairman of the Committtee of the Board on Water Supply and Sewerage.

Experimental filters were constructed of different mate-

rials, such as would be found in suitable filtration areas throughout the State. Each filter, however, consists of a single material. The experiments were so conducted as to throw as much light as possible upon the laws of filtration. The degree of purification of sewage and of water by the sands of different coarseness, the quantities which the different materials are able to purify, the best method of operation of filters of different construction, and the treatment necessary under varying conditions arising from different lengths of service of the filters and from the effects of weather have been investigated. Much attention has been given to the physical characteristics of materials which govern their action as filters. The open space between the sand grains, the capillarity and the frictional resistance to the passage of water, etc., have been determined for many materials.

Knowing, from the results of these experimental filters, the degree of purification of sewage and of water effected by each of a series of materials ranging from fine loam to coarse gravel, and having formulated the physical characteristics of these materials which govern their action as filters, it is now possible, by studying the physical characteristics of materials sent to Lawrence by cities and towns desiring to adopt filtration, to predict with reasonable accuracy what their efficiency will be as filters. From this it will be readily seen that these investigations do away, in a large measure, with the experimental nature which would otherwise be attached to the operation of large and expensive filter plants. The object of the Lawrence Experiment Station, in short, is to study the laws of filtration with a view to economy.

In regard to the efficiency of filtration, it may be stated, in passing, that sewage can be applied to areas of coarse (mortar) sand 5 feet deep, at a rate of 120,000 gallons per acre daily, with a removal of 95 per cent of the organic matter and germs in the applied sewage. With finer sand the purification is still more complete, but the quantity which can be successfully treated is less. By means of chemical precipitation it is possible, under the most favorable conditions, to remove only from one-half to two-thirds of the organic matter from sewage.

One of the most important points in water purification is the removal of disease-producing germs, since it has become clearly established that high death-rates from diseases, caused by germs which can live in water, result largely from drinking polluted water. The results of the Lawrence experiments show that it is possible to construct filters which will purify at least 2,000,000 gallons of water per acre daily and remove more than 99 per cent of the bacteria in the unfiltered water.

The theory of filtration and a large amount of information upon the actual operation of filters have been presented in the annual reports of the Board and in the special report upon Purification of Sewage and Water, 1890—a volume of 881 pages.

Large sewage filters are in successful operation at Framingham, Marlborough and Gardner, in this State, and others are in the process of construction. A large filter, also, to purify the water supply for the city of Lawrence, is nearly completed.

It is interesting to note the increasing confidence with which this work of the Board is regarded by sanitarians and engineers, not only in this State but throughout the United States and in foreign lands.

The advance in methods of analysis is worthy of note, and more especially in the interpretation of the results of analysis. Old methods have been improved and new ones devised, as well as some pieces of apparatus, which it is believed are not to be found outside the laboratories of the Board—except at their exhibit in the Anthropological Building at the World's Fair.

ASEPSIS—PREVENTION BETTER THAN CURE.

BY ALBERT S. ASHMEAD, M. D., NEW YORK.

THERE is a singular agreement of precept between some of our new philosophical schools and the doctrine of the Orientals as to our duty to the race in case of disease. The doctrine of our philosophers, teaching the survival of the fittest, and our duty to the race, not to interfere with the eliminating operations of nature, is not put into practice, and considering that Christianity is our religion and is not looking forward at present to any imminent decline, it is not likely to pass into practice for some time to come. The Orientals criticize Christianity because it seems unduly and undutifully occupied in counteracting the decrees of nature, by saving, with fostering care, individuals of the race, preserving in hospitals all that ought to perish, and heaping up, so to speak, the sweepings of nature, to perpetuate moral and physical uncleanness. True, they also are anxious to build hospitals; but if they were let alone perhaps they might build them only for animals, whose races are not important enough to make it a pity that disease and vice should be allowed to be transmitted among them from generation to generation. Wherever the Oriental spirit has developed on its own lines, it has endeavored to eradicate the human weed, to sweep away all human influences detrimental to mankind, whether they be represented by disease or by crime, always ready to sacrifice any man to the interest of men. The leper was cast out to die with his disease in unpitied misery and solitude; the beggar, unable to earn his bread or support his family, was excluded from help and intercourse of any kind; what could the race expect from his seed? What is the use of amputating a limb which tuberculosis or syphilis or leprosy is gnawing at? Why should his seed be preserved to perpetuate his rottenness? Why should we so tenderly humor the madman, use infinite care and infinite treasures of knowledge, and miracles of skill, to bring the diseased brain into a condition which makes the man innocuous, tolerable, while yet he can never be normal, rational, useful; his brain fibre is degenerated and should not be transmitted to future generations.

When we Westerners discovered the bacterium we thought that here we had the cursed cause of all disease, and forthwith began to give her chase or to lay siege to her citadel. The Oriental may have thought dimly: Wherever you are, O, Microbe, you are in the state where Providence has placed you and must do her behests. Yours is the empire of the abnormous, the morbid, the destructive. Whatever part of creation you establish yourself upon is by your very presence stamped as bad, unhealthy, undeserving of existence. Therefore stay in your domain, we do not envy it to you. Eat up what belongs to you, it can do us only harm. These Eastern populations believe in fate; they are the true Stoics. What is written, is written, Kismet. If we are doomed to be cut off by cholera we shall not escape it, and the fear of the inevitable shall not prevent us from plunging our limbs into the lethal waters of the Ganges, or quenching our thirst in the Mecca pools. And what does it mean, that our own people, not very long ago, considered the use of vaccine as being an interference with the will of Providence. They called Providence what in the Orient we call fate. It would seem that medicine in general is just the opposite of this magnificent supineness: the physician tries to save his individual, let what may become of the race; there is another kind of recklessness, not supine like the Oriental, but busy and officious. It would be a much higher task, if, instead of waging war against the bacillus, who has invaded an individual, medicine should find means to obviate and suppress the bacil-

lus, or its development, or its culture, before it invades the race by the individual, that is, should create in the organism such conditions, should produce such constitutions, as would not allow of the existence of these microscopical pestilences. That would be asepsis instead of antisepsis. Here is what asepsis has to do. It stands at the fountain head, its mission is to keep the spring of life free from impurity. Let a commission, or whatever body of scientific information and action, go to Russia, to the original habitat of the typhus germ, oppose the development of its colonies before they begin their trip around the world. The first thing to do will probably be to improve the condition of the Russian Jew. Prevent the Hindoos from poisoning themselves with their holy water, with which they drink the blessing of cholera. Enact laws to isolate the syphilitic and the tuberculous. Prohibit the marriage of such. Let the congenitally incurable die before puberty: it is better that the offending limb should be lost than that tuberculosis, syphilis, leprosy, etc., should spread through the whole body. Let the healthy, the temperate, the moral, alone have the inheritance. A correct life is the most perfect asepsis, and insures an immunity with which the burnt infant's immunity, known as such, cannot compare.

THE "GOPHER FROG."

BY FREDERICK CLEVELAND TEST, U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

THROUGH the kindness of Mr. H. G. Hubbard, of Crescent City, Florida, I am enabled to make a note on the habits of the "gopher frog," *Rana areolata æsopus*, Cope. This form seems to be so rare in collections that so far the only specimen reported as having been identified with this sub-species is the type in the National Museum, from Micanopy, Florida, and described by Professor Cope in the Proceedings of the American Philosophical Society for 1886. I have been unable to find any published mention of its habits, which are peculiar.

It appears to be almost entirely subterranean in its habits, living in the holes and burrows of the "gopher" turtle, *Gopherus polyphemus*, in conjunction with it, and apparently on the best of terms. Roughly described, it is grayish green, with thirty-five or forty ragged black spots arranged in four or five irregular longitudinal rows on the back, and grading off into smaller spots on the flanks, while the legs are barred with about fifteen half-rings of black, from the thighs to the toes. Beneath it is white, with the throat marbled with very dark brown. The body is rather flat, with wide head and sharp-pointed snout, and the two dorso-lateral ridges, together with indicated folds between them, are greenish brown. The size is about that of a small "leopard frog," *Rana pipilus*, or the "swamp frog," *Rana palustris*, to which last it is closely related, although individuals are said to have been seen weighing two or three pounds. But those must have been huge toads, noticed by persons unable to distinguish between them and the frogs, or too unobserving to make the distinction. Its food has not been ascertained, from dissection of the stomachs of freshly captured specimens, but as these frogs are rarely seen away from the burrows, it is probable that they feed on the insects living in the burrows, for the holes possess a flourishing insect fauna, to a great extent peculiar to them.

On cloudy and rainy days the frogs sit at the mouths of the burrows—as many as three have been found in a single burrow—but on the approach of a human being dive down out of sight, and as the holes are from 12 to 20 feet in length, and 7 or 8 in vertical depth at the end, digging the frogs out is no easy matter, especially as the sandy soil has a tendency to cave in on the excavator. But the frogs may be successfully angled for with a fishing line and small hook baited with a grasshopper.

In the fact that the burrows usually or always go down to water, may be found an explanation of the frogs inhabiting them, and the facility of procuring insect food therein may be an additional inducement, as well as their being safe hiding places. Nothing seems to be known of the habits of the other varieties of the species, of which also but few specimens are known, *Rana areolata areolata*, from Texas and Georgia, *Rana areolata capito*, from Georgia, and *Rana areolata circulosa*, the "Hoosier frog," found in Indiana and Illinois. It is to be hoped that further observations will be made upon this interesting species, and additional specimens collected.

ALTITUDE AS THE CAUSE OF THE GLACIAL PERIOD.

BY WARREN UPHAM, SOMERVILLE, MASS.

Among the numerous difficult questions which are now being investigated and discussed by glacialists, none seems more important or worthy of attention than the cause, or the causes and conditions, which produced the Glacial period, with its very exceptional accumulation of ice-sheets upon large continental areas in the north and south temperate zones. Climatic conditions like those to-day prevailing in Greenland and on the Antarctic continent, both now covered by ice-sheets whose central portions are several thousands of feet thick, then prevailed in North America as far south as to Long Island, New York, Cincinnati, St. Louis, Bismarck and Seattle, reaching to a more southern latitude in the moist eastern half of the United States than in its mostly arid western half. Likewise Scandinavia, Great Britain south to London, Germany south to Berlin, and the northwestern half of Russia, were enveloped by ice. The glaciers of the Alps, too, of other European and Asiatic mountain ranges, of the Rocky Mountains, and of the mountains of New Zealand, were far more extensive than now; and in South America a broad ice-sheet covered Patagonia.

Three chief theories have been proposed to account for the great climatic changes made known to us by the extent of these areas of glacial drift. During the past twenty years all glacialists have been greatly interested in the astronomic theory of Dr. James Croll, so ably advocated by him in his volume, "Climate and Time," and by Prof. James Geikie in "The Great Ice Age," attributing the ice accumulation to climatic conditions attendant upon an epoch of maximum eccentricity of the earth's orbit. American glacialists, like those of Great Britain and continental Europe, were several years ago very generally inclined to think that this was a true and sufficient explanation. At the present time, however, a majority of the advanced students of this subject, at least in America, doubt that this theory is applicable to the observed facts of glaciation. For, in accordance with Dr. Croll's view, glacial periods should be recognizable with geologic frequency through the earlier Tertiary and Mesozoic eras, where, on the contrary, evidence of glacial conditions is wholly absent or exceedingly scanty, being wherever it is known probably referable to Alpine rather than continental glaciers. Besides, it seems within the past ten years to be fully ascertained that the time since the disappearance of the ice-sheets of North America and Europe has been only 6,000 to 10,000 years, whereas if they had depended on the astronomic causes mentioned their departure must have occurred some 80,000 years ago.

A second theory, accounting for the Glacial period by changes in the position of the earth's poles, and consequently in the latitude of the countries glaciated, which

was first proposed by Sir John Evans in 1866, has therefore lately attracted the favorable consideration of some American glacialists, and in Europe has been championed by Nansen in his very interesting work, "The First Crossing of Greenland." This theory supposes that within so late a part of the earth's history as the Ice age, the north pole may have moved to the region of southern Greenland and returned, giving in the period of its digression glacial conditions for all the lands adjoining the North Atlantic Ocean, and the same for the antipodal, then south polar, portion of the globe. A small observed variation of latitude, discovered several years ago by German and Russian astronomers, seemed to give a foundation for this view, but within the past two years the brilliant investigations of Dr. S. C. Chandler, showing that these variations are of very small amount and in two short periods, one of fourteen and another of twelve months, while no appreciable secular change of latitude can be recognized, leave to us no basis for this theory of the cause of accumulation and disappearance of ice-sheets.

The third theory, which the writer believes to be applicable, sufficient and acceptable for all the observed facts of the Glacial period, attributing the ice-sheets to high altitude of the drift-bearing countries, has also been long under consideration, having been first suggested in 1855 by Dana, but failed until recently to receive adequate appreciation on account of the supposed geologic improbability of sufficiently high uplifts of so extensive portions of the earth's surface. During the past few years, however, this neglected theory has received full attestation by independent evidence, apart from the facts of glaciation, that these countries, and also other parts of the terrestrial coast, have been, in the same late geologic era which includes the Ice age, raised thousands of feet above their present height, to altitudes doubtless having so cool climate as to bring snowfall during nearly the entire year, the most favorable condition for the formation of ice-sheets. This evidence consists chiefly in the very great depth found by soundings in fjords and the submarine continuations of river valleys, where streams flowed formerly and eroded their valleys, showing these lands to have then stood far higher than now.

The Hudson River channel is traced somewhat more than a hundred miles out to sea, to a maximum depth of 2,844 feet. Similar depths are known by the United States Coast Survey and British Admiralty soundings, as Prof. J. W. Spencer has pointed out, for the former continuation of the Mississippi and St. Lawrence rivers and in the entrance of the Gulf of Maine, between Cape Cod and Nova Scotia. All about our northern and Arctic shores, from Maine around to Puget Sound, abundant fjords prove the land to have been formerly much elevated. On the coast of California, submarine valleys discovered by Professor George Davidson, of the U. S. Coast Survey, reach to depths of 2,000 to 3,120 feet; and Professor LeConte has shown that they are of late Tertiary and Quaternary age, probably contemporaneous with the submerged valleys of our Atlantic coast, and closely associated with the Glacial period. In the fluvial deposits of the Mississippi River, laid down while the ice-sheet was being formed, Professor E. W. Hilgard finds evidence that the interior of our continent northward, about the sources of the Mississippi, was then uplifted not less than 3,000 feet above its present height. Likewise the fjords of Scotland and its adjacent island groups, and especially the much deeper fjords of Scandinavia, prove for that glaciated region an altitude thousands of feet higher than now, the maximum depth of the Sogne fjord, the longest in Norway, being stated by Jamieson as 4,080 feet. In the same way, New Zealand and Patagonia, formerly glaciated, are remarkable for their abundant, long and branching fjords. But the most surprising known submerged continuation of any river valley is that of the Congo, which, according to Mr. J. Y. Buchanan, is determined, by soundings for a cable to connect commercial stations on the west African coast, to be about eighty miles long, descending to the profound depth of 6,000 feet below the sea level.

The Congo valley, only about four hundred miles south of the equator, proves that the epeirogenic uplifts, causing glaciation, were not limited to drift-bearing regions. Where the uplifted areas were in so high latitudes, both north and south, that their precipitation of moisture gave snowfall during all, or nearly all, the year, they began to be covered by snow, which became consolidated below into ice and grew in depth to hundreds and thousands of feet.

Why the earth during the Glacial period was extraordinarily deformed for comparatively short periods by great epeirogenic movements of elevation and correlative depression of other tracts, is a more fundamental and not less difficult question, for which I have attempted an answer in an appendix of Wright's "Ice Age in North America," ascribing these movements to stress stored up previous to its relief by the folding, overthrust and upheaval of mountain ranges. This explanation, although diverging widely from formerly assumed conditions of continental stability, seems yet well consistent with Dana's doctrine of the general permanence of the continents and oceanic basins.

NOTES ON THE DISTRIBUTION OF SOME OF THE CONIFERS OF NORTH-WESTERN CANADA.

BY J. B. TYRRELL, OF THE GEOLOGICAL SURVEY OF CANADA.

THE following observations on the limits of some forest trees were made while conducting geological surveys in the interior of northwestern Canada, in the country extending from Lake Winnipeg northwestward to the Athabasca River.

White Spruce (*Picea alba*) is the most important timber tree of this whole region. It occurs throughout the heavily wooded districts from Riding and Duck Mountains, in northern Manitoba, northwestward to the great forest region between the Saskatchewan and Churchill rivers, and thence westward beyond the Athabasca. North of the upper part of Churchill River it extends into the rocky granite country for a short distance and then disappears, so that its general northern limit is here reached at, or south of, the height of land; but while the writer was travelling across Little Hatchet Lake, in north latitude 58°40 and west longitude 103°45, a high sandy island was found on which was a small grove of tall white spruce, some trees with a diameter of fifteen inches. None others were seen anywhere in the vicinity. This grove, therefore, forms a little outlier in the surrounding scattered forest of small black spruce and Banksian pine, the hill of warm dry sand furnishing it with a sufficently congenial home. Extending in from the west the white spruce occurs on and around the shores of Lake Athabasca, but it does not appear to grow at any great distance back from the lake. Black Spruce (*Picea nigra*) is usually a smaller tree than the last, and is scattered on the low lands everywhere thoughout the forest regions of the Province of Manitoba, and the District of Saskatchewan, but north of the Churchill River, and southeast of Lake Athabasca it often ascends to the higher lands. Its northern limit for this region has not yet been traced. Balsam Fir (*Abies balsamea*) grows to a large size among the white spruce on the top and sides of the Duck Mountain in Manitoba, and between the Saskatchewan and Churchill rivers in the District of Saskatchewan. It

extends for a short distance north of the Churchill River, where it appears to reach its northern limit.

Tamarac (*Larix Americana*) is found growing on the low wet land from the northern edge of the prairie region, northward as far as Lake Athabasca, but its northern limit has not yet been reached.

Cedar (*Thuya occidentalis*) has its general northwestern limit east of Lake Winnipeg, but an isolated colony occurs on the high ridge between Winnipegosis and Cedar lakes, two hundred miles distant from the general limit. No trace of cedar could be found in the intermediate country.

Red Pine (*Pinus resinosa*) also has its general northwestern limit some distance east of Lake Winnipeg, but an outlying grove is said to occur on Black Island, a large sandy island in the lake. Cones collected from trees on this island, and undoubtedly belonging to this species, were sent to the writer by Mr. A. Neison, of Badthroat River.

Scrub Pine (*Pinus banksiana*) grows on the high stony morainic hills on the northeastern portion of Duck Mountain, and on the sandy ridges to the north.

From here it extends northward and northwestward, keeping north of the heavy white spruce forest. It is the principal tree in the rocky and sandy region from the Churchill River northward to Black River, where it grows to a height of from twenty to forty feet, and to a diameter of from eight to twelve inches. On the more level sandy plains it here forms typical pine barrens, the trees being thinly scattered over the surface, while the land beneath them is quite devoid of undergrowth and there is little or no fallen timber, so that the whole country has a park-like aspect. On the rocky slopes it has taken root in the niches and crevices, and is usually stunted and very irregular. It extends north of Black River and Lake Athabasca, and its northern limit has not yet been traced.

THE AFFINITIES OF BASQUE AND BERGER.

BY CANON ISAAC TAYLOR, M. A., LL. D., LITT. D., YORK, ENGLAND.

In the Transactions of the Berlin Academy for June, 1893, Professor Von der Gabelentz has published a paper in which he endeavors to establish a connection between Basque and the languages belonging to the Berber family of speech, such as Kabyle and Tuareg. He admits that the results of his comparison are small, the languages differing in structure of speech, in gender, and in most of the formatives. But he urges that they had certain analogous laws of phonetic change, and that there is a resemblance in a few culture words, mainly the names of animals and of articles of dress. The paper is one of the numerous examples of the way in which pure philologists may be led astray by want of an adequate acquaintance with anthropology. The author bases his attempt on a recent paper in *Ausland* on the craniological resemblance between the Berbers and the ancient Iberians. He then assumes that Basque represents the ancient Iberian speech, whereas Van Eys and Vinson, the two highest authorities, consider that it is impossible to explain such remains as we possess of the ancient Iberian by means of Basque. Broca, moreover, has proved that while the skulls of the Spanish Basques resemble, to some extent, those of the Iberians, the skulls of the French Basques belong to a different type. It is now believed that the race to which the French Basques belong imposed its language on the Spanish Basques, a feebler people of the Iberian type. If this is the case, the results obtained by Von der Gabelentz would be easy of explanation. A conquered people acquiring the language of their conquerors would retain their own phonetic tendencies, and at the same time would incorporate into the acquired language certain classes of words such as those which agree in Basque and Iberian, notably the names of articles of dress and of domesticated animals. In short, the ancient Iberian may have affected Basque much in the same way that Celtic has affected English and French. It has introduced sundry phonetic tendencies, and some loan words belonging to certain classes. Hence we may still hold fast to the old conclusion that the nearest affinities of Basque are with Accadian and the languages of the Ural-Altaic type.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

THE SO-CALLED SAND OF GREAT SALT LAKE.

The white deposit which covers Garfield Beach and the adjacent shore of Great Salt Lake, Utah, although commonly called sand, does not consist of true sand. An examination under a low magnifying power, such as that afforded by a common pocket lens, shows that all the particles or grains composing this so-called sand are very smooth and shiny, many being globular, others ovoid, and others dumb-bell and club-like in form. None of them present angular or irregular surfaces, and none have sharp edges or points. When treated with hydrochloric or nitric acid this oölitic "sand" rapidly dissolves with energetic effervescence, leaving but tiny little specks of silicious matter behind, which latter form nuclei in the centre of the oölitic grains. The solution thus obtained contains lime. A very careful scrutiny under high microscopic powers shows the most of each grain to consist of a white, fibrous or somewhat crystallized mineral, with a central enclosed bit of dark gray mineral, that which is left as silicious undissolved matter after the acid treatment aforesaid. In fact I have found a few grains containing nuclei so large that they could be readily seen by the unaided eye. It appears, therefore, that each grain of this deposit is a nodule or concretion, consisting of white crystalline calcite, containing a minute bit of silica or silicious matter as a central nucleus around which the calcite has collected. Some months ago Professor Rompletz reported traces of what he regarded as an alga in oölitic sand from the shores of Great Salt Lake. But Dr. George Jennings Hinde, F. G. S., of London, who has made recent examinations of samples of this oölitic "sand," writes me that he has not discovered any evidence of organic orgin in it. In all other respects Dr. Hinde's observations seem to agree with those made by me during the past year.

HENRY MONTGOMERY.

University of Utah, Salt Lake City, July 31.

NATURE'S ROTATION OF CROPS.

An open sandy field which the writer has passed several times a week, for the past ten years, has illustrated well this fact.

No record has been kept, but for the past five years, my recollection is accurate, and for a longer period, I am sure that the "crops" have been of the character stated, though the order of succession may not be strictly correct.

Seven or eight years ago there was a yield of *Œnothera biennis* which was phenomenal. The following year there was scarcely a plant of this species to be noticed, but a fine crop of mullein succeeded. Daisies followed the mullein, the next year daisies and golden rod (*S. nemoralis*). The year after the solidago took full possession and was a most magnificent crop. The year following but little golden rod could be seen, and very few daisies. Last year was the most magnificent crop of *Hypericum perforatum* I have ever seen. When in blossom, the field was one mass of solid color; it seemed the petals must touch

each other over the whole surface of the entire field. It was a glory not to be forgotten. This year not a plant of the species is visible riding past. Scattered daisies, golden rod (not *S. nemoralis*), a few *Œ. biennis*, and an occasional lespedeza (*L. capitata*) are all that show. The ground is very sparsely covered, whereas last year it was completely occupied, as indeed also by the daisies, the œnothera, and the golden rod in their respective years.

I am satisfied the same thing takes place on other unoccupied sandy fields about here, but I have not watched them as closely nor as regularly as this one. M. W. V.

Fort Edward, N. Y., July 29.

Worms on the Brain of a Bird.

To judge from Professor French's communication under this title in the current volume of *Science*, p. 20, he is unacquainted with the description and figures of the thread-worm of the snake bird given by Prof. Jeffries Wyman, in 1868, in the Proceedings of the Boston Society of Natural History, Vol. 12, p. 100. Samuel H. Scudder.

A Space-relation of Numbers.

The recent notes and discussions as to certain curious relations observed by some persons between sensations of color and of sound,—relations hardly conceivable by others who, like myself, have never experienced them,—have led me to reflect upon a peculiar conception of my own, which may be called a space-relation of numbers. I have never heard it alluded to by any one; but it has been constant with me since childhood, and seems so peculiar and inexplicable that it may be worthy of mention and inquiry. It is presented, therefore, in the hope that the experience of others may throw some light upon it as a mental phenomenon, and help to show whether it be a mere idiosyncrasy or an experience at all known, and, if the latter, how far familiar, and with what, if any, modifications.

My first distinct recollection of this idea goes back to the age of nine or ten years, in connection with learning the multiplication table. This I was taught, not at school, but by home instruction, and without any use of cards, tables, slates, abaci, or any visible signs or aids whatever. It was purely abstract and *memoriter*. Somehow, then, and ever since, the numbers from 1 to 100 have been conceived of by me as holding, relatively, definite positions in space, from which they never vary,—the mention or use of the number being at once associated with its position relative to other numbers, in the same way that the mention of a well-known country or river brings up a mental picture of its geographical location.

This numerical position has no relation with that of any other object or thing, nor with the position of the body or the points of the compass. In describing it, however, I must employ the latter, but simply as aids, in place of a diagram. The numbers, which are conceived of merely as points or stations in space, appear to be arranged in a peculiar line or lines in a horizontal plane. Beginning with unity, the series runs in a straight line to 20, where it turns ninety degrees to the right, and so goes to 30. Using the points of the compass merely for the present description, as above stated, and not from any connection with the number-scheme itself,—if the series 1-20 runs (say) northward, 20-30 runs always east, 20 being the apex of the right angle. From 30 to 40 the course is *reversed* and runs back westward; at 40 it again turns at a right angle and proceeds south, without interruption, to 90, where the line again turns east from 90 to 100. Above this point, the numbers have the same positions again, and so in each succeeding hundred; so that the same description applies to all.

It will be seen by any one who attempts to put this scheme on paper, that, according to the arrangement, the numbers 30 to 40 would coincide, in reverse order, with 20-30, 40 falling upon the same spot as 20; while 40-60 would coincide with 1-20, in reverse order. But in the mental conception this is not the case. The line 30-40 seems parallel to 20-30, but at some little distance; and a vague sense of space, gradually increasing until no distinct relation is consciously noted, prevents any approach or interference between the numbers above 40 and those below 20. This fact confirms the impression that the idea is not due to any artificial aid in the way of diagram, table, or the like, in childhood.

The only suggestion that occurs is found in the fact that about that period the family had lived for some time in a large hotel (the Delavan, at Albany), whose corridors and numbered rooms may have impressed themselves on the child-mind in some such way. But I distinctly recall that certain of those rooms, occupied at different times by the family, did not at all have the positions that their numbers hold in this mental scheme.

Be this as it may, however, the clearness and the persistence of this association are remarkable, and I should be greatly interested to know if others can report any similar experience. If certain chords in music can suggest the sensation of purple, or the sound of a word a corresponding impression of blue, etc., as apparently is the case with some persons, why may not certain abstract numbers have similar associations of space-position?

D. S. Martin.

New York, Aug. 3.

Preliminary Note on the Cottony Scale of the Osage Orange.

In June I found a Cottony Scale (*Pulvinaria*) in some abundance on an osage-orange tree (*maclura*) in Las Cruces, N. Mex. The young were hatching on and about June 14th. This scale would be referred by modern entomologists to *Pulvinaria innumerabilis* (Rathvon) Putnam, but finding that it did not agree very well with published accounts of that species, I sent to Professor Bruner for specimens of the true insect, which abounds at Lincoln, Neb. Professor Bruner very kindly forwarded without delay a number of examples from box-elder, which were evidently not quite the same as my osage-orange scale.

The box-elder scale, however, agrees with *innumerabilis*, while the *maclura* scale is what was formerly named *maclurœ*, and afterwards sunk as a synonym of *innumerabilis*.

The most conspicuous and constant difference is in the size. In order to show this, I boiled the adult females (which had formed ovisacs) in caustic soda, and spread their skins flat on a glass slide. Thus treated, the measurements were as follows:

P. maclurae (Las Cruces) . . length 10, breadth 10 mm.
P. innumerabilis (Lincoln) . . " 7½, " 5 "

It is thus seen that *maclurae* is both larger and broader in proportion; and no intermediate specimens were found. Another difference is in the length of the fourth joint of the antenna: in the Las Cruces *maclurae* it is about as long as the third joint, whereas in the Lincoln *innumerabilis* it is decidedly shorter than the third. I have not yet examined enough specimens to make sure if this character is invariable. I do not wish to assert positively that *L. maclurae* is a valid species, but its characters are such as have been held to distinguish species of *Pulvinaria* in Europe. I hope to set the matter at rest hereafter by the examination of more extensive material, but it must be admitted at least that it is a very distinct race or variety. In this we revert to the original opinion of Fitch, Walsh and Riley (1855, 1860, 1868), which has been set aside for so many years.

In order to be sure that I had rightly identified the two forms, I sent specimens to Professor Riley. He at once replied: "You are perfectly correct. A. [this refers to the lettering of the specimens] is the form which I described as *Pulvinaria maclurae*, while h. is identical with typical specimens of *Pulvinaria innumerabilis* on maple."

It appears that Robert Kennicott was the first to suggest the name *maclurae*, and Fitch to publish it. This was in the *Country Gentleman*, Jan. 18, 1855. In 1868 Messrs. Walsh and Riley published another description of the osage orange scale, also using the name *maclurae*. Those who do not consider the *Country Gentleman* a proper medium for scientific description may cite Walsh and Riley as nomenclators. If this should be done, it would seem that *innumerabilis* Rathv., published in the *Pennsylvania Farm Journal*, 1854, has at least no better standing, in which case Fitch's name *acericorticis*, given in the *Trans. N. Y. Agric. Society*, 1860, should be employed, or if it be insisted that the description must appear in a purely scientific publication, we must fall back on *acericola*, Walsh and Riley, 1868! For my own part, I would use the earliest name in each case, but one must allow that this is a matter for legitimate differences of opinion.

Thus we have—

(1.) *Pulvinaria innumerabilis*, Rathv., 1854. The Cottony Scale of the Maple.
— *acericorticis*, Fitch, 1860.
— *acericola*, W. & R., 1868.

(2.) *Pulvinaria maclurae*, Kenn. MS., Fitch, 1855. The Cottony Scale of the Osage Orange.
— *maclurae*, W. & R., 1868.

It need hardly be pointed out that the separation of these races or species is a matter of some interest to economic entomologists. T. D. A. Cockerell.

Las Cruces, N. Mex., July 29, 1893.

Explosive Gas in Hot Water Apparatus.

In the hot water apparatus, used in heating houses, it is well known that gas or "air" accumulates from time to time. This is let off from the radiators where it may collect by turning the "air" tap provided; otherwise the accumulation under ordinary circumstances would interfere with the circulation of water through the pipes. Being curious as to the nature of this gas, on a certain occasion I smelled it when escaping from the tap, and detected a peculiar odor of what I took to be a hydrocarbon compound. Collecting some of the gas, I cautiously applied a light to it, which produced an explosion.

The furnace was a small, upright one, with the water heated between its double walls, large enough to warm in winter time a house of seven or eight ordinary rooms. Anthracite coal was used.

With a larger upright furnace, having tubes for the smoke and heated gases to pass through in its upper part, in addition to the water-filled sides of the first, the amount of gas collecting in the highest radiator in the house was more abundant, especially when anthracite was used instead of bitumenous coal, for which the furnace was also adapted. As a matter of fact, several litres of gas were produced each week in two neighboring houses supplied with this latter style of furnace, during the period of observation,—a few weeks during last winter.

A considerable quantity of the gas was collected for demonstration before a popular meeting of the Institute of Science. Jars of various sizes were filled with the gas, which was burned under various conditions. 1st—The peculiar odor of the gas was tested. 2nd—It burned in the jars when inverted, and otherwise very much like pure hydrogen, giving forth very little light, but much heat. 3rd—The products of combustion showed no trace of carbonic dioxide which could be detected by the lime water test, which was sensitive enough to detect its presence in the room from the respiration of those present. From this it was inferred that neither carbon monoxide nor a hydrocarbon could be present in any considerable quantity. 4th—Pure nitrogen dioxide injected into the gas gave no ruddy discoloration. Hence, there was no oxygen in the gas. 5th—When mixed with air it would explode like air and hydrogen. 6th—It was not convenient at the time to apply any other tests, or any very accurate ones. The impression was formed that the gas must be nearly pure hydrogen.

If it was nearly pure hydrogen it must have come from the decomposition of the water, which would apparently imply a corresponding oxidation of the iron piping or of the heated iron in contact with the water within the furnace. The greater abundance of the gas when anthracite was used suggested that the origin of the gas was the rapid oxidation of the water tubing within the furnace when the heat was particularly intense. If so, every litre of hydrogen produced would mean the conversion of over one and a half grains of metallic iron into "rust."

Again, if a lighted match should be applied to the tap when this gas (pure) is being allowed to escape, the jet would catch fire and "roar" with a hot, bluish flame, of dimensions as terrific as the bore of the tap would allow. As by the "boiling over" of the furnace the small tank and upper coils under some conditions of water pressure may be emptied and filled with air, what would the consequences be were the mixed gases allowed to escape at night with a lamp held in the hand carelessly near such a jet?

The discussion of these demonstrations revealed the fact that no one present ever knew or heard that the gas escaping from radiators might be explosive—not even the builders, plumbers and founders.

Query 1. Is the formation of explosive gas within the hot water apparatus of our houses rare, peculiar to certain furnaces, or is it common?

Query 2. Has an accurate analysis of such gas been made; and if so, what are its constituents?

A. H. MacKay,

Halifax, N. S.

Mineral Wax.

In *Science* of July 14th, page 25, I notice an article on "Mineral Wax," from which the following is an extract: "In the United States it (mineral wax) is mined *in situ* at Soldiers' Summit, Uintah County, and in Emery County, Utah." Permit me to state that Soldiers' Summit of this Territory is in Utah County; that mineral wax or ozocerite is not mined at Soldiers' Summit, nor in Uintah County, nor in Emery County, Utah. I greatly regret to have thus to correct the writer of the aforesaid article, for it would be an especial pleasure to me to be able to report mines and mining of ozocerite from Utah. I think a small quantity of it occurs in Emery County. But it is not yet mined. Of course, it may occur in large quantity in Utah, but up to the present time no satisfactory evidence of such occurrence has been presented. It is, however, possible at present to report ample and satisfactory evidence of the occurrence in Utah of large quantities of three related hydro-carbons, viz.: *wurtzilite*, *uintahite* and *asphaltum*. Of these, the first has not yet been mined; but the second and third are being mined with some degree of activity.

Uintahite, often called Gilsonite, after a resident prospector and miner in this vicinity, yields black varnish. It is very light, being only a little heavier than water. Its color is black, and its streak is brown or reddish-brown. It possesses a brilliant, shiny lustre, and has a perfect conchoidal fracture, like that of glass, quartz and obsid-

ian. In fact, it is not infrequently mistaken for black obsidian or volcanic glass, which also occurs in great quantity in this Territory. Uintahite is also very brittle. When heated it melts readily, but will not burn. This substance is hauled in wagons from the mines near Fort Duchesne, in Uintah County, to Pleasant Valley Junction, on the Rio Grand Western Railway, a distance of more than a hundred miles, to be shipped East for the manufacture of varnish.

Wurtzillite bears a remarkably close resemblance to uintahite. It has a similar color, lustre, fracture and specific gravity, and it is about equally brittle. But wurtzillite readily burns, yielding a bright light from the combustion of illuminating gases. Again, its streak is black, and it is slightly sectile, being capable of being cut or pared by a knife much as rubber or horn may be pared. Wurtzillite has been reported from Wasatch County, as well as from Emery and Uintah Counties, in considerable amount. Asphaltum occurs in Emery and San Pete Counties. It is somewhat mixed with sand and other impurities, but it is already being mined in considerable quantity for paving the streets of various Western cities.

In addition to wurtzillite, uintahite, asphaltum and ozocerite, other hydro-carbons are found in Utah; for example—albertite, petroleum and natural gas. But, as yet, none of the latter have been made productive.

HENRY MONTGOMERY.

University of Utah, Salt Lake City, July 29.

ANIMAL VOCABULARIES.

A good deal has been said about the probable existence of definite vocabularies in the language of the lower animals, and I believe one has gone to Africa to study Simian speech. This is all well enough, but there is no need of going beyond the barn yard to hear a definite animal vocabulary of a considerable number of words. Hear the rooster's warning cry when he sees or hears indications of danger. It is a definite sound, and perfectly understood by every hen and chick. Drop food to the mother hen. She quickly inspects it, and if approved, tells the little ones to eat, by uttering her well known "Coot, coot, coot!" If she decides that it is not fit to eat, she as plainly tells them to let alone. The other day a green worm fell from a tree near a brood of chickens. Every chick ran to seize the morsel. The mother gave one quick glance at the insect and said, "*Skr-r-r-p!*" Every chick stopped instantly. But one wilful child, loth to believe his mother's assurance that it wasn't fit to eat, would make him sick, etc., started a second time to pick up the worm. "*Skr-r-r-p!*" commanded the hen sharply. Even the wilful child obeyed this time, and the whole brood walked off contentedly. Discuss as we will the particular reason for the hen's cackle before and after laying, the fact remains that it is a definite utterance, as plainly understood by both gallinæ and homines as any expression in human speech.

My horse has a low whinny which means "water," and a higher-keyed, more emphatic neigh means food. When I hear these sounds I know as definitely what she means as if she spoke in English. This morning, passing along the street, I heard that same low whinny and, looking up, saw a strange horse regarding me with a pleading look. I knew he was suffering from thirst, and no language could make it plainer.

The language of the lower animals is not all articulate. It is largely a sign language. The horse does a deal of talking by motions of the head and by his wonderfully expressive looks. He also, upon occasion, talks with the other extremity. A peculiar switch of the tail and a gesture, as if threatening to kick, are equine forms of speech. The darkey was not far wrong who said of the kicking mule, "It's just his way of talking!"

The dog can not only "look volumes," but can express whole sentences by wags of the tail more readily than can the waving flags of the signal corps. All that is necessary is to learn his code. We expect our domestic animals to learn our language, and punish them cruelly if they fail to both understand and obey our commands; yet, notwithstanding our higher intelligence, we fail to learn their language, by means of which we might better understand their wants and dispositions, and thus control them by kindness and sympathy, instead of by harsh and arbitrary treatment. I see horses passing along the street, which are saying by every look and motion that they are suffering acute torture from a too short check rein. Their drivers are often people who would be shocked if they could comprehend their own cruelty. But they do not understand horse language, and some of them do not seem to have horse sense.

The language of animals is a neglected subject. The facilities for its study are within the reach of all, and no previous preparation is required. The study can be pursued without interfering with other occupations, and even a little systematic observation will bring large returns in both pleasure and profit.

CHARLES B. PALMER.

Columbus, Ohio.

A MAYA MONTH-NAME—KHMERS.

In *Science*, Aug 4, Professor Thomas gives a new name to the 17th month of the Maya calendar on the basis of a phonetic rendering of its symbol.

I do not intend to dispute the correctness of his rendering; I think it quite possible he is right; but I seriously question his inference, that, because the symbol reads *ak-yab*, that therefore was the month-name.

The work *kayab* is from the verbal stem *kay*, to sing or warble. As this concept cannot be objectively represented, the Mayas had recourse to a method very familiar with them, that of the rebus, to convey or keep in memory its approximate sounds. They chose to indicate the guttural initial *k* by a turtle, called in their tongue *ak*; prefixing it to the syllable *yab*.

This method of writing is what I have called "ikonomatic," and I have shown abundant instances of it in Mexico and Central America. (See my "Essays of an Americanist," pp. 213-229). Through neglecting to regard its principles, both Prof. Thomas and Dr. Seler have made several obvious errors in translating the Mexican and Maya codices, as I expect to show in a work I am preparing on the calendar system of those nations.

With regard to the origin of the Khmers and their ethnic affiliation, I do not think that Professor Keane's claim is relevant to that put forward by Dr. Maurel. The latter maintains that the Khmers belong to the "Aryan," in the sense of the "Sanscritic" peoples; and that they are in Cambodia an intrusive stock, arriving practically within historic times. I understand Professor Keane to differ with both these opinions.

D. G. BRINTON.

Media, Aug. 7.

THEORY OF COLOR SENSATION.

An objection to my theory of color-sensation (an abstract of which has lately appeared in *Science*) has been more than once made to me, which needs to be met, but which can be met very easily. It is that I suppose the three primary color-sensations to be conveyed to the brain by one and the same nerve, and hence that the theory is not consistent with the widely accepted doctrine of the specific energy of nerves,—the doctrine, namely, as applied to the eye, that we recognize two reds to be like sensations, not by any specific quality in the sensation, but by the fact that they affect the same set of nerves, and that if a pure blue light could by any possibility be

made to cause these nerves to "vibrate" (to use the original Helmholtzian term) the sensation communicated to consciousness would still be red. But this doctrine, which has strong reasons in its favor, as regards the sense of hearing, had never much support in the sense of smell and taste, and has now been totally disproved for the sense of sight.

A few years ago Holmgren announced a remarkable discovery, and at the same time a remarkable confirmation of the original theory of Helmholtz. He caused a very minute image of a point of light to fall upon the retina, so minute as to be smaller in diameter than the diameter of the rods and cones. If this image was of white light, it felt to the observer sometimes red, sometimes green and sometimes blue, as it moved about the retina; if it was of yellow light, it looked sometimes red and sometimes green; and the primary colors were at times altogether invisible. If this observation had been confirmed by other investigators, it would have proved conclusively that each minutest fibre of the optic nerve responds only to a limited range of vibration-periods of light, and that, as Helmholtz at first was inclined to suppose (he says explicitly in the first edition of his *Physiological Optics* that the three effects *may* all be capable of being transmitted by a single nerve), three adjacent fibres must participate in conveying a sensation of grey to the brain. But this observation of Holmgren has *not* been confirmed. The experiments have been repeated by Hering with quite opposite results, and he has also detected the probable source of Holmgren's error; and Hering's results have been confirmed in Helmholtz's laboratory. Hering's paper on the subject was published in *Pfluger's Archiv* some four years ago; I am unable to look up the exact date, as the admirable free public library of Duluth as yet lacks scientific books of a non-popular character. In view of these experiments, no writer on physiological optics (not even Helmholtz) at present expresses himself in any other language than that which implies that all the physiological processes essential to the production of grey-sensations and of color sensations may go on in a single cone (if not in a single rod).

C. L. FRANKLIN.

Duluth, Aug. 2, 1893.

CURRENT NOTES ON ANTHROPOLOGY.—NO. XXXII.

[Edited by D. G. Brinton, M. D., LL. D., D. Sc.]

RECENTLY PUBLISHED AMERICAN CODICES.

So rare are the documents which escaped the fanatic iconoclasm of the early missionaries, that it is a most agreeable duty to chronicle the discovery and publication of hitherto unknown Codices, or native manuscripts, of the Mexican and Central American peoples.

Last year, the American Philosophical Society published in admirable style the Codex Poinsett, the fragment of a pre-Columbian book relating to the collection of taxes in the ancient empire of Anahuac (a term entirely proper, in spite of Dr. Seler's onslaught upon it). Its name was given to it after Mr. Poinsett, formerly minister of the United States to Mexico, who brought it from that country and presented it to the Society, which has at considerable cost had it carefully chromo-lithographed and incorporated in its Transactions.

With not less praiseworthy zeal the Royal Library of Berlin has within the present year issued fac-similes of sixteen fragments of native Mexican MSS., brought from that country by Alexander von Humboldt, accompanying them with a small volume (pp. 136) of explanatory text from the pen of Dr. Seler, whose knowledge of the subject places him in the very front rank of Mexicanists. A few of these fragments, three or four of them, date anterior to the conquest; but the majority are subsequent to it, though none probably later than 1571. They are all of value in the study of the hieroglyphic script.

A third Codex of remarkable interest, and unquestionably ancient, has been published at Geneva by M. Henry de Saussure under the title of "Le Manuscrit du Cacique." It contains sixteen pages or plates, in colors, and tolerably well preserved. According to the statements about it, it is not of Nahuatl, but of Mistecan origin, which would increase its value, as this tribe is one of whom we have few monuments, though we know its culture ranked high, and dated from remote antiquity. It is said to contain the biography of a certain powerful Cacique, by name Sar Ho, whence the name given it.

The great libraries of our country should not delay to secure copies of these three ancient documents, as they are all published in limited editions, and they should be placed within reach of those in this country who devote some of their time to the fascinating problem of American hieroglyphic writing.

ETHNOLOGIC JURISPRUDENCE.

The first volume of a work, which will certainly be an epoch-making one, has appeared in Germany. It is Dr. Albert Hermann Post's "Grundriss der Ethnologischen Jurisprudenz" (A. Schwartz, Leipzig). It will be followed by a second volume, which will not be long delayed.

The author is already well known as a leading student in this department of ethnology, and also as a profound thinker on the fundamental problems of the social relations of man. In his present work he sets out in the first volume to exhibit all the primitive forms of law, custom and procedure, so that from them the fundamental and universal principles of the jurisprudence of all nations can be deduced. The second volume will indicate the development of these general principles in special fields of human law.

In this first volume, Dr. Post defines the elementary forms of the social organization as all reducible to four, the consanguine, the territorial, the feudal, and the social; or, the tribal, the communal, the regal and the democratic. Each of these has its own peculiar theory of what relates to ethics, rights and laws; and though in minor details there are constant and wide variations, each is controlled in its development by obedience to certain underlying principles, which place its moral and legal codes on diverse paths of development. They are in a measure historically sequent, the consanguine organization always being that of men in the lowest stages of culture, while the true social organization is as yet chiefly ideal, and may never be fully reached in practice.

The style of the author is terse and clear, and his reading is most extensive and accurate. The field he has chosen is a comparatively new one, and the results he has reached are in the highest degree of immediate and practical importance. It has been well said by Dr. Krauss, of Vienna, in a recent publication, that it would be a fortunate chance to substitute some of Dr. Post's reflections on the rights of humanity for the wholesale murder stories which stir the heart of youth in the school readers, under the name of patriotic wars.

THE STUDY OF PREHISTORIC ARCHÆOLOGY.

Now that archæology is recognized to be the only guide where history is silent, and often the more trustworthy guide where history talks a good deal, its systematic study should interest all who occupy themselves with questions of the higher education.

Dr. Hoernes, whose work on that branch has been already mentioned in these columns, contributes to the last number of the Zeitschrift für Ethnologie a scheme for the instructor, which is intended to present all the science in the most favorable manner for the student. It is as follows:

Explanatory.

Relations of prehistory to history and to anthropology, both physical and ethnological.

Systematic.

1. Introductory. History of the science. Sources of information, literary and monumental, with critical estimates of their values.

2. Methodical presentation. Geographical and ethnic divisions. Factors of evolution, as discovery, borrowing, alteration, descent. Special forms, as language, religion, law, family, government, clothing, food, ornament, commerce, etc.

3. Typological presentation. Models of workshops, houses, fortresses, altars, sepulchres; also weapons, tools, utensils, etc.; their use and development.

4. Historical presentation. First, with reference to natural history, the origin, races, varieties and migrations of men; second, cultural history, as the stone, bronze and iron ages; the palæolithic and neolithic periods; proto-historic culture; dawn of civilization, etc.

This scheme appears to offer a comprehensive plan for bringing the science before a class.

Migration of the Aztecs.

The Society of Geography and Statistics of the Republic of Mexico has just issued a second edition of a work by its first secretary, the licentiate Eustaquio Buelna, entitled "Peregrinacion de los Aztecas, y Nombres Geograficos Indigenas de Sinaloa."

The first edition was published in 1887, and received a certain measure of praise on account of the new material it offered concerning the tribes and languages of northwestern Mexico. This has been added to in the present edition, and in this respect it is welcome; but that the author has seen fit to expand and illustrate his theories on the pre-historic migrations of the Aztecs, is to be regretted, as he does but disseminate under the name of the society various exploded errors.

When, for instance, shall we hear the last of the "Atlantis?" Over and over again, its existence has been disproved, but it is ever rising in the minds of those who do not know what time o' day it is in science. How often must it be shown that the name "Atlantic" has nothing to do with "Aztlan" or "Aztalan," but is a Berber word meaning "mountain." Yet Buelna repeats and adopts these eighteenth century etymologies. Our faith in his acquirements in the Nahuatl language wanes considerably when we find him (p. 323) deriving the word *nahuatl* from *nahui*, four, and *atl*, water, for it is elementary that the terminal *tl* is dropped in composition. Of course, the "Toltecs" figure largely, although their existence as a nation has been disproved.

It cannot be said that Senor Buelna has approached this part of his subject with the requisite knowledge of its literature; and one cannot but regret that he seems unacquainted with the voluminous writings of Buschmann on the proper names and languages of Sinaloa and Sonora.

Note on Crotalus Adamanteus.

February 22, students while out collecting birds shot a diamond rattlesnake, *Crotalus adamanteus*, Beau., that measured five feet ten inches in length and nine inches around the thickest portion of the body. From the glossiness of the scales it is thought that it had recently moulted. There were only five rattles and a button present, which seems quite remarkable for such a long reptile. If I am not mistaken, such large animals of this species usually have more.

These animals, though once quite abundant, are becoming quite uncommon. The demand for their skins and rattles to make into Florida has done much to destroy this venomous animal. The skin is made into belts and neckties, while the rattles are used for sets on the ties and elsewhere.

P. H. Rolfs.

Fla. Agr. Coll., Lake City, Fla.

BOOK-REVIEWS.

Le Lait par P. Langlois. Paris, Gauthier-Villars et Fils, Quai des Grands-Augustins, 55. 188p. 8°.

La Biere par L. Lindet. Paris, Gauthier-Villars et Fils, Quai des Grands-Augustins, 55. 206p. 8°.

The above treatise on Milk, by P. Langlois, Chief of the

Physiological Laboratory of the Faculty of Medicine of Paris, is divided into two parts—the first treating the subject theoretically, the second from the technical standpoint. Beginning with a chapter on chemical composition, the author proceeds with a discussion of the phenomena of coagulation, of milk secretion, and of the varying composition of different milks. A chapter each is devoted to woman's milk and to cow's milk, while others treat of the digestibility of milk, infant alimentation, and milk micro-organisms. The technical portion treats of milk analysis and adulteration. Under the first head is given in detail the admirable method used at the Municipal Laboratory of Paris, as well as the methods of Grandeau, Quesneville, and Adams. The various rapid methods are discussed in detail, and excellent means for the preservation of milk suggested. The book is new and a welcome addition to our literature on the subject.

Dr. L. Lindet, in his work on Beer, has produced a manual valuable to all interested in Brewing, either as a scientific study or from the purely technical view. The last half of the book is devoted to the practical process of brewing, following in main the procedure adopted in France, the limitations of the book preventing a more general discussion. The first part, however, is of wide interest, treating in an attractive and scientific manner Barley, Malt, Yeast and Hops, of the processes of saccharification, and of alcoholic fermentation. A shorter preliminary chapter touches upon the legislation and statistics regarding beer. The book does not impress one as a mere compilation from more exhaustive authors, but is distinctly a treatise upon the state of the science at the present hour, and is a most convenient book for reference.

These volumes form part of the Encyclopédie Scientifique des Aide-Mémoire, published under the direction of M. H. Léauté, Member of the Institute of France. This publication, which is distinguished by its practical character, is moreover scientific in its accuracy and in the authorative names which appear upon the title pages. When complete (it has been published at the rate of thirty or forty volumes a year since Feb., 1892,) there will be about 300 volumes uniform in binding and embracing the entire domain of applied science; Mechanics, Electricity, Engineering, Physics, Chemistry, Agriculture, Biology, Medicine, Surgery and Hygiene. In each case the most competent men have been selected to treat of their respective specialties, and while within the limits of an octavo volume of 200 pages it is necessary to leave out much of interest, still the authors of those works which it has been my pleasure to read have accomplished much in their difficult condensation, treating of their subjects in a fluent manner and omitting nothing essential. Each volume is terminated with a bibliography which enables the reader to pursue to its source any particular line of study.

C. P.

—The American Book Company have just issued a revised edition of William Swinton's "School History of the United States," the first edition of which appeared some twenty years ago. As the author is now dead, the revision of the work has been done by the editorial department of the Company, and the history has been continued to the present time. The book is well printed, and contains many maps and illustrations. Another book from the same house is a series of "Exercises in Greek Prose Composition," based on the first four books of the Anabasis and prepared by William R. Harper, President of the University of Chicago, and Clarence F. Castle, assistant professor of Greek in the same institution. The Company have also issued two volumes of their "English Classics for Schools," one of them containing three of Emerson's essays, and the other being an edition of Matthew Arnold's "Sohrab and Rustum," with an introduction giving a sketch of his life and writings and some other matter useful to the student.

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

I wish to exchange a New Model Hall Typewriter, price $30, for a Daylight Kodak, 4x5 preferred. George A. Coleman, Dep't. Agric., Div. of Ornithology, Washington, D. C.

Exchange—The undersigned is desirous of obtaining correspondents interested in macro-lipidoptera, in Alaska, the far Western, Southwestern and Southern States. Will also exchange rare lepidoptera for entomological literature. Levi W. Mengel, Reading, Penn.

Wanted to exchange—Medical books, Obstetrical Transactions, London, Works of Sir J. Y. Simpson, Beck's Medical Jurisprudence. Handbook for the Physiological Laboratory, by Burnton, Foster, Klein and Sanderson, Quain's Anatomy, and about fifty others. Catalogues given. Want Geological, Botanical and Microscopical books in exchange. Dr. A. M. Edwards, 11 Washington St., Newark, N. J.

A complete set of Bulletins of U. S. Geological Survey, various reports and bulletins of surveys of Missouri, Arkansas, Minnesota, Alabama, Illinois, New York, Pennsylvania, Indiana, Ohio and Texas; iron ores of Minnesota; Wailes' Agriculture and Geology of Mississippi (rare). To exchange for periodicals and books on Entomology or for Lepidoptera. Rev. John Davis, the Deanery, Little Rock, Ark.

For sale or exchange.—A complete set of the report of the last Geological Survey of Wisconsin. T. C. Chamberlin, geologist. It consists of four large volumes, finely illustrated, and upwards of forty large maps and charts. Will sell for cash or exchange for a microscope. Address Geo. Beck, Platteville, Wis.

I have a fire-proof safe, weight 1,150 pounds which I will sell cheap or exchange for a gasoline engine or some other things that may happen to suit. The safe is nearly new, used a short time only. Make offers. A. Lagerstrom, Cannon Falls, Minn., Box 857.

Wants.

WANTED.—A position as teacher of Biology, by an experienced teacher, a college graduate with four university post-graduate courses in the Sciences. Good endorsements, and eighteen years' experience. Address A. N. Somers, La Porte, Ind.

WANTED.—Assistant in Nautical Almanac office, Navy Department. The Civil Service Commission will hold an examination on August 15 to fill a vacancy in the position of assistant (computer) in the Nautical Almanac office. The subjects will be letter-writing, penmanship, trigonometry, rudiments of analytical geometry and calculus, logarithms, theory and practice of computations, and astronomy. Each applicant must provide himself with a five-place logarithmic table. The examination will be held in Washington, and if applications are filed in season, arrangements may be made for examinations in the large cities. Blanks will be furnished upon application to the Commission at Washington.

DRAFTSMEN WANTED.—The Civil Service Commission will hold examinations on August 15 to fill two vacancies in the War Department; one in the position of architectual draftsman, salary $1,400, the other in the position of assistant draftsman, Quartermaster General's office, salary $1,200. The subjects of the architectural draftsman examination are letter-writing, designing specifications and mensuration, and knowledge of materials; of the assistant draftsman examination they are letter-writing, tracing, topographic drawing and projections. The examination will be held in Washington, and if applications are filed in season, arrangements may be made for examinations in the large cities. Blanks will be furnished upon application to the Commission at Washington.

A YOUNG man who has been through the course in mathematics in Princeton University, wishes some tutoring this summer. Rates reasonable. Address P. H. Westcott, Cramer's Hill, Camden Co., N. J.

A GRADUATE of an American Polytechnic institution and of a German University (Gottingen), seeks a position to teach chemistry in a college or similar institution. Five years' experience in teaching chemistry. Address Chemist, 757 Cary St. Brockton, Mass.